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TITLE: Method and system for configuring dynamic interfaces

Abstract Text (1):
Dynamic interfaces such as PPP interfaces are configured by (1) saving routing configuration information using symbolic names; (2) determining when a symbolically named interface becomes active; (3) resolving the symbolic name to an operational IP address for routing and RIP traffic; and thereafter (4) communicating dynamic protocol packets over the dynamic interface.

Brief Summary Text (6):
The Internet is organized into a number of networks connected by gateways. The networks may be either point-to-point links or more complex networks such as Ethernet or the token ring. Hosts and gateways are presented with IP datagrams addressed to some host. Routing is the method by which the host or gateway decides where to send the datagram. It may be able to send the datagram directly to the destination, if that destination is on one of the networks that are directly connected to the host or gateway. When the destination is not directly connected, and thus not directly reachable, the host or gateway attempts to send the datagram to a gateway that is nearer the destination. The goal of a routing protocol is to supply the information that is needed to do routing. (See Network Working Group, Routing Information Protocol, Request for Comments (RFC) 1058, June 1988, pp. 2-3.)

Brief Summary Text (7):
Routing is the task of finding a path from a sender to a desired destination. This may be viewed as a matter of finding gateways between networks. Internet protocol (IP) routing deals with communicating messages from a sender on one such network to a destination on a different one. In that case, the message must pass through gateways connecting the networks. If the networks are not adjacent, the message may pass through several intervening networks and the gateways connecting them. A "network" may cover a single broadcast network (e.g., an Ethernet), a point to point line, or a packet switch network, such as asynchronous transfer mode (ATM). A network is treated as a single entity by IP. Either no routing is necessary (as with a point to point line), or routing is done in a manner transparent to IP, allowing IP to treat the entire network as a single full-connected system. IP is the network layer of the TCP/IP protocol stack.

Brief Summary Text (10):
address: in IP implementations, this will be the IP address of the host or network.

Brief Summary Text (20):
There are two basic schemes used to manage IP address assignments for point to point (PPP) links. These are (1) fixed assignment and (2) dynamic assignment. Fixed assignment is generally used for dedicated links while dynamic assignment is used for dial-up. Historically, dynamic address assignment was used for single remote workstations which don't require the need to run a dynamic routing protocol. An address depletion problem exists today which has resulted in the need to use dynamic address assignment for entire remote local area networks (LANs). As a

result, it has been necessary to run dynamic routing protocols over interfaces that don't have single fixed IP addresses.

Brief Summary Text (21):
While running the Routing Information Protocol (RIP), dynamic interfaces can change their state from active to inactive and the reverse. When such an interface becomes active from an inactive state, it may or may not have the same IP address associated with it. If needed, it would be difficult to configure such a dynamic interface because there exists no constant value that can be used to identify the interface.

Brief Summary Text (25):
It is a further object of the invention to provide the processing advantages of running a dynamic routing protocol over an interface with a changing IP address.

Brief Summary Text (27):
In accordance with the method of the invention, configuring dynamic interfaces includes the steps of (1) saving routing configuration information using symbolic names; (2) determining when a symbolically named interface becomes active; (3) resolving the symbolic name to an operational IP address for routing and dynamic routing protocol traffic; and communicating dynamic protocol packets over said dynamic interface.

Detailed Description Text (2):
This invention provides a method and system for establishing routing paths among offices within a system including both wide area networks (WANs) and local area networks (LANs). More particularly, it relates to the configuration, activation and deletion of point-to-point interfaces. Through the use of symbolic names, the RIP protocol is run over dynamic point-to-point interfaces. As interfaces are activated and deactivated, addresses are negotiated so they can't be hard coded. By configuring to symbolic names, when an IP address is negotiated, the configuration can be applied and RIP executed.

Detailed Description Text (8):
Referring to FIG. 2, in a preferred embodiment, an interface configuration table 140 is provided with an entry for each interface 110, 132 including the interface name 216 (which is one of (a) a logical interface name for a dynamic interface, or (b) an IP address for a non-dynamic interface), an interface type or source field 212 set to LAN or WAN, a redistribution bit mask 210 and a "distribute routes in" (DRI) field 214.

Detailed Description Text (12):
RIP interface name 216 specifies the RIP interface 110, 132 on host 100 this statement, or entry in table 140, pertains to. It may include a network, specified as an IP address and a mask or an IP address and a bit number, or as an interface name, which is a logical interface name used to identify a dynamic interface which will have an IP address assigned dynamically at the time connection 130 becomes active; or as a host name; or as *, which is used to refer to all interfaces 110, 132 on host 100 to set default values that can be overridden by providing a RIP interface statement.

Detailed Description Text (15):
A RIP_INTERFACE statement is used to specify all routing related options that are configured on a per-interface basis. Multiple interface options can be specified on a single entry in configuration file 140, provided that only one of those options that require a destination address appears on a given statement. For example, a statement could use the forward and metric options on a single line, but the forward and noforward options could not appear on the same line. Preferably, multiple lines are used to specify multiple options for a given interface.

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Detailed Description Text (17):
Referring to FIG. 3, route table 138 includes for each active interface 250, 252, 254 interface source fields 212, 274, 278, associated configuration fields 272, 276 and 280 and one or more route entries 271, 273, 275. Interface source 212 corresponds to the local IP address 170 from message 194. Configuration source fields 272, 276 and 280 include corresponding fields 272 from interface configuration table 140. Each route entry 271, 273, 275 includes destination network 281, gateway 283, time value 285, metric 287, and learned interface 289. Destination network 281 is derived by ANDing the subnet mask against either the local or remote IP address to generate a destination network IP address. Gateway 283 is the remote IP address of the next hop, and is obtained from remote IP address field 180 of message 194. Learned interface 289 is the IP address of the interface from which this route entry 271 was learned. Metric 287 is the current value of the metric associated with this route 271, whereas the metric 217 in configuration 272 is the initialization value which is subject to change by RIP traffic to derive the current value metric 271.

Detailed Description Text (20):
Version field 162 is set to 0.times.02, indicating that this message 194 pertains to RIP version 2. Address family identifier field 166 is set to 0.times.01C7. Subnet mask field 184 represents the subnet mask address to be associated to logical interface name (LIN) 182.

Detailed Description Text (21):
Configuration type field 178 identifies the address configuration of dynamic link 130. The possible values are (1) 0.times.01 existing local IP address, (2) 0.times.02 existing local network address, or (3) 0.times.03 unique host address.

Detailed Description Text (22):
IP address fields 170 and 180 represent the IP address to be associated to the logical name 182. Logical interface name 182 contains a character string representing a logical interface name. A local IP address 170 is the IP address of local end 132, and remote address 180 is the IP address of remote end 121, of dynamic connection 130.

Detailed Description Text (23):
Subnet masks are used to determine network addresses as follows. The IP address and subnet mask are ANDed to determine the network. For example, if the IP address is 10.5.6.7 (hex 0A 05 06 07) and the subnet mask 255.255.255.0 (hex FF FF FF 00), these are ANDed to give 10.5.6.0 as the subnet address. Valid address on this subnet are 10.5.6.0 through 10.5.6.253.

Detailed Description Text (26):
The result is that RouteD 104 has an IP address which it can advertise to interfaces 110, 132 showing the network address (in decimal dotted notation) and a logical or symbolic interface name 182 from message 194.

Detailed Description Text (29):
Referring to FIG. 5, the key inter-relationships among the elements of the invention as set forth in FIGS. 1-4, will be described. In the preferred embodiment, RouteD 104 is the key active (software) element. As is represented by line 151, PPP configuration module 241 receives a connection request 144 from data link layer 246, which includes a user-selected logical name. Responsive to that connection request 144, PPP configuration code 241, during making of the connection to bring up a dynamic link, associates the logical name with an IP address. As is represented by line 152, PPP configuration 241 generates an activation message, or interface start message, 194 which includes the logical name 182 from the connection request, and the local IP address 170 and remote IP address 180 which PPP configuration code 241 associates with the logical name 182.

Detailed Description Text (36):
This sequence of events is necessary to negotiate an IP address and network information, for such is not a known value. A standard router will simply exchange routing information over this new connection with no preconceived configuration for that interface. This is the problem that the present invention resolves. In accordance with the invention, the PPP interface 130 characterized by the local and remote IP addresses may be associated with a name 182 (or logical name, or symbolic name--they all refer to the same thing) that, in turn, is used to associate a predefined configuration with the interface.

Detailed Description Text (39):
2. The negotiated local IP address 170.

Detailed Description Text (40):
3. The negotiated remote IP address 180.

Detailed Description Text (50):
Clearly, any computing system capable of interfacing to a network may be configured to operate as a router operable in accordance with this invention, including but not limited to those which are configured according to the ISO networking model. Such systems include, for example, the IBM AS/400 system, and also the IBM System/390 computing system, and the IBM Personal Computer. Further, it is within the scope of the invention to provide a memory device, such as a transmission medium, magnetic or optical tape or disc, or the like, for storing signals for controlling the operation of a computer according to the method of the invention and/or to structure its components in accordance with the system of the invention.

CLAIMS:

1. A method for configuring dynamic interfaces, comprising the steps of:

saving routing configuration information using symbolic names;

determining when a symbolically named interface becomes active;

resolving the symbolic name to an operational IP address for routing and creating dynamic routing protocol packets; and thereafter

communicating said dynamic routine protocol packets over said dynamic interface.

2. A method for configuring dynamic interfaces for routing and creating dynamic routing protocol packets, comprising the steps of:

initializing a configuration table with entries for each of one or more active interfaces and associated interface configuration information;

initializing a route table with an entry for each active route;

responsive to a request to activate a dynamic interface, said request including a logical name:

establishing a physical connection to said interface; and

negotiating an IP address defining said interface;

generating a message packet including said logical name and said IP address;

responsive to said message packet, obtaining from said configuration table configuration information associated with a local interface name matching said logical name;

adding a route entry to said route table including information from said configuration table and said message packet associated with said IP address; and

communicating routing protocol packets over the dynamic interface configured with said IP address and said configuration information.

3. The method of claim 2, said IP address comprising a remote IP address and a local IP address and said routing protocol packets being RIP packets.

4. The method of claim 3, said route entry including a destination network IP address, a gateway IP address, a time value, a metric, and learned interface IP address.

5. A system for configuring dynamic interfaces, comprising:

an interface configuration table for saving routing configuration information using symbolic names;

a routing table for storing the configuration information for at least one route identified by an operational IP address;

a configuration control module responsive to activation of a symbolically named interface for resolving the symbolic name to an operational IP address for said dynamic interface for routing and creating dynamic routing protocol packets;

said configuration control module updating said routing table with a route entry including said operational IP address for said dynamic interface; and

a router module responsive to said route entry for communicating said dynamic routing protocol packets over said dynamic interface.

6. A memory device for storing signals for structuring the components of a digital computer to configure a dynamic interface, comprising:

first configuration signals for operating said digital computer to save routing configuration information using symbolic names;

second configuration signals for determining when a symbolically named interface becomes active;

third configuration signals for resolving the symbolic name to an operational IP address for routing and creating dynamic routing protocol packets; and thereafter

third configuration signals for communicating said dynamic routing protocol packets over said dynamic interface.